LAKE STATES ASPEN REPORT NO. 10

ASPEN FOR CONTAINERS

BY
WALDO SANDS
LAKE STATES FOREST EXPERIMENT STATION

JULY 1947

PROCESSED BY
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
LAKE STATES FOREST EXPERIMENT STATION

FOREWORD

During and since World War II, there has been increasing interest in aspen (Populus tremuloides) in the Lake States, its availability and supply, properties and uses, and management. Aspen is a tree of primary importance in 20 million acres or 40 percent of the total forest area of the three Lake States - Michigan, Minnesota, and Wisconsin.

At an informal meeting at Madison, Wisconsin, in January, 1947, forestry representatives of several federal, state, and industrial groups in the Lake States agreed that it would be desirable to bring up to date what is known on aspen and make it available to anyone interested. The job of preparing this information in the form of reports was assigned to each of the groups listed below. The reports will be duplicated as rapidly as completed, and the entire project should be finished by the end of 1947. Each report will concern one aspect of the subject. Copies will be available from the Lake States Forest Experiment Station or from each contributor.

Report Number	Subject
1	Aspen Properties and Uses
2	Aspen Availability and Supply
3	Logging Methods and Peeling of Aspen
4	Milling of Aspen into Lumber
5	Seasoning of Aspen
6	Aspen Lumber Grades and Characteristics
7	Mechanical Properties of Aspen
8	Machining and Related Properties of Aspen
9	Aspen Lumber for Building Purposes
10	Aspen for Containers
11	Aspen for Core Stock
12	Small Dimension and Other Industrial Uses of Aspen
13	Aspen for Veneer
14	Aspen for Pulp and Paper
15	Aspen for Cabin Logs
16	Aspen for Excelsior
17	Aspen Defiberization and Refining of Product
18	Chemical Utilization of Aspen
19	Preservative Treatment of Aspen
20	Marketing of Aspen
21	Possibilities of Managing Aspen

Contributors to Lake States Aspen Reports

Lake States Forest Experiment Station, St. Paul 1, Minn.
Forest Products Laboratory, Madison 5, Wis.
North Central Region, U. S. Forest Service, Milwaukee 3, Wis.
Div. of Forestry, Univ. of Minnesota, University Farm, St. Paul 1, Minn.
School of Forestry and Conservation, University of Michigan, Ann Arbor, Mich.
Department of Forestry, Michigan State College, East Lansing, Mich.
Michigan College of Mining and Technology, Houghton, Mich.
Superior Wood Products, Inc., Duluth 2, Minn.
Forestry Agent, Chicago & North Western Railway System, St. Paul 1, Minn.

REPORT NO. 10

ASPEN FOR CONTAINERS

By
Waldo Sands, Forest Economist
Lake States Forest Experiment Station 1/

INTRODUCTION

Aspen, because of its abundance in the Lake States, merits special consideration as to future management, utilization, and marketing. Although aspen lumber is used for many purposes, its chief use during the past decade has been for containers (boxes and crates). It gained its greatest prominence as container material during World War II.

Both producers and users of containers need general information as to availability and supply of aspen, its properties and usefulness for container material. With that in mind, this report on the use of aspen for containers has been prepared.

VOLUME OF ASPEN IN LAKE STATES

Aspen occupies 19,858,000 acres, or 39 percent of the commercial forested area in the Lake States. There are 6 1/3 billion board feet of aspen saw timber in trees 9 inches and over with a larger volume in small trees; it is important therefore as a continuing source of supply for container material. Minnesota produces the best quality aspen and contains approximately one-half of the total usable volume. The other 50 percent is about equally divided between Michigan and Wisconsin.

At the present time, the larger aspen logs and bolts are obtained largely from overmature and decadent timber stands, and consequently include a considerable amount of heart rot. Smaller bolts in many cases are obtained from aspen growing on lands repeatedly burned, and they likewise contain considerable defect in the form of bark cankers. As long as timber must be obtained from unmanaged stands, this high percentage of defect must be tolerated. If aspen lands were properly managed, however, the quality of the timber could be improved appreciably, and the rate of loss through mortality could be curtailed.

TREND IN USE OF ASPEN FOR CONTAINERS

The use of aspen for containers increased tremendously during the past

---

1/ Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota, University Farm, St. Paul 1, Minnesota.

ten years, and particularly since 1941. Wartime government restrictions on the use and movement of lumber such as southern and western softwoods curtailed the usual supply of container material. This forced manufacturers in the Lake States to turn to local woods. They found aspen satisfactory in quality and strength, and in some cases, preferable to species formerly used. Box and crate factories in the Lake States now consume the greatest portion of aspen lumber.

In addition to lumber, there is a considerable volume of aspen material not classed as lumber that is consumed by the veneer container industry. In 1946, for example, nearly 10 million board feet of aspen bolts were used principally for the manufacture of sawed veneer box headings. A small amount of aspen was also processed into container veneer.

Veneer container plants are still operating at full capacity and the present rate of wood consumption is expected to continue for at least another year. Shipment of cheese to foreign countries continues on such a large scale that cheese box manufacturers have been unable to meet the demands for boxes.

The effect of the increased use of aspen for containers during recent years is reflected in the following table showing aspen lumber production:

Aspen lumber production, 1941 to 1946

Million board feet

State	1941	1942	1943	1944	1945	1946
Minnesota	43.7	58.0	53.8	59.9	51.0	68.4
Michigan	8.6	14.6	17.9	23.9	21.3	26.6
Wisconsin	14.6	37.7	25.7	34.9	34.6	57.3
Total	66.9	110.3	97.4	123.7	106.9	152.3

THE LAKE STATES CONTAINER INDUSTRY

Types of Containers Manufactured

Types of containers manufactured in the Lake States using aspen in whole or in part are listed as follows:

1. Agricultural Containers (fruits and vegetables)

    Bushel baskets (flat bottom type, veneer sides, bottoms aspen)
    Climax baskets (veneer sides, bottoms aspen)
    Celery boxes and crates
    Shipping lugs (for cherries and tomatoes)
    Field crates

Shipping boxes
Berry crates (aspen heading)

2. Dairy, Meat, and Poultry Product Containers

Fish boxes
Cheese boxes
Butter boxes
Egg cases
Fresh and smoked meat boxes
Cottage cheese tubs
Lard tubs

3. Returnable Containers

Poultry boxes
Bread boxes
Beverage cases (beer, soft drinks, milk)
Banana boxes

4. Industrial Containers (boxes and crating)

Explosive boxes
Canned goods shipping containers
Machinery boxes
Hardware boxes
Office equipment
Piano boxes

5. Crating

Furniture
Stoves

6. Miscellaneous Containers

Wire bound boxes (veneered box frames)
Caskets, rough boxes

Practically all containers manufactured in the Lake States are used locally; only a few are produced for consumption outside the region.

Woods Commonly Used in Container Manufacture

Because of their lighter weight combined with adequate strength properties, high percentage of long, wide boards, availability in large quantities, and lower prices, the softwoods are most commonly used in container manufacture.

The species most frequently used for container lumber are ponderosa pine, southern pine, white, jack, and red pines; red, white, and

sitka spruces; western red cedar, cypress, western hemlock, and Douglas fir. Low grades of northern hardwoods, yellow poplar, and southern gums are also used.

The species most commonly used for container veneers are red and black gum, elm, maple, ash, yellow poplar, cottonwood, western pine, southern pine, spruce, and fir.

ASPEN AS A CONTAINER MATERIAL

Compared to other woods commonly used in container construction, aspen rates well because its white color, light weight and strength, and freedom from odor appeal to the consumer. Some container manufacturers rate it almost as highly as ponderosa pine for box construction. Studies made by the Forest Products Laboratory of the suitability of little-used species for containers indicated that boxes made of lodgepole pine, ponderosa pine, and aspen gave the best results. (See FPL Mimeographed bulletin R1402 - Suitability of Little Used Species for Containers - March 1929). Average properties of aspen as compared to other competitive woods are shown in Table 1.

The many qualities which make aspen desirable container material may be summarized as follows:

1. It is free from pronounced taste or odor. This makes true aspen desirable for use in packaging and shipping food products such as butter, fish, cheese, and meats. Care must be exercised by the user of aspen lumber for food containers that balm of Gilead lumber is not included in the manufacture of food containers as it will contaminate the food with its odor.

2. Although not as strong as some other container woods, its light weight, reasonably good strength, white color (when not stained), and good appearance combine to make it a wood suitable for nearly every type of container use.

3. It takes ink, paint, and glue well.

4. It wears smooth.

5. It is particularly suited for re-use containers, where light weight is an important factor.

6. It has little tendency to split under stress.

7. It provides a cheap source of crating.

8. Like other woods of low density when nailed onto other woods having high nail holding qualities, aspen makes a light, strong crate.

9. It nails easily without splitting.

Aspen also has some drawbacks as a container material:

1. It is low in decay resistance, and would not be suitable when in constant contact with moisture.

2. Aspen lumber generally is produced in short lengths, mostly from small diameter logs and bolts. This results in narrow boards from which only a low percentage of good cuttings can be obtained, and necessitates an unusual amount of building up for most box panels.

3. Much aspen lumber is likely to be discolored with stains, thereby limiting use of such material where a good clear white appearance is required.

4. Lack of volume production by any one producer frequently results in inability of the consumer to secure an adequate supply of lumber to meet his box needs.

FACTORS AFFECTING CONSUMPTION OF ASPEN

Availability of Sufficient Volume

The volume of aspen consumed by the container industry in future years will depend on new and expanded uses for containers, future supply, and decrease in availability of other species. If the present trend in use of aspen for container material continues, the demand may well increase to over 150,000,000 board feet per year in the Lake States.

The supply of available aspen for container use is also affected by competition with other industries for this wood. Much is consumed by the Lake States pulp industry, 439,000 cords in 1944 alone. Aspen is also used for manufacture of excelsior, roofing and insulating materials, railroad ties, fence posts, cabin logs, and veneer.

Unfortunately, from the lumber standpoint, all these above industries seek the best timber for their individual uses, thereby reducing the available saw timber supply. This also affects the quality of the lumber produced since operators, to keep going, frequently have to operate in stands of small, inferior quality timber.

All these factors will have a decided influence on the ability of producers to provide sufficient volume of material suitable for container use in the future.

Quality of Material

During the war the container industry accepted aspen lumber containing a high percentage of lower grades and narrow boards.

Today, the increased availability of such species as ponderosa pine and the southern pines has changed the picture. Also, these species are

available in greater widths than aspen lumber. Although more expensive as raw material, they give more efficient use of box-factory labor.

To meet competition of other woods, aspen lumber producers should strive to produce wider boards, freer of decay and knots than heretofore. This will help decrease waste in the container plants, by increasing the proportion of clear or sound cuttings. Improved seasoning and dressing of container lumber will help meet industry's requirements and reduce transportation costs to the consumer.

Another important factor in the production of aspen lumber is the absolute necessity for segregation of balm of Gilead lumber, which is highly odorous, from that of true aspen. Both the lumber producer and container manufacturer should inspect their shipments carefully to see that no other lumber species is included. One or two cases of food contamination because of inclusion of balm of Gilead in aspen containers would hurt the market for aspen.

Current heavy demands for cheese and fruit containers have created a strong incentive for some manufacturers to take advantage of the market by steadily increasing the price of their product. Many box manufacturers are becoming worried over the possible repercussion of the rising price trend. It is only natural to expect that unless aspen container manufacturers keep the price of their product at a reasonable level, consumers will scrutinize the field more closely for a cheaper type of box, possibly manufactured from competitive material, such as western box shooks which were used in large quantities prior to the war. In other words, the quality of aspen lumber will have to be improved if the container market is to be retained and additional markets captured.

Comparative Prices

The location of lumber supplies in relation to the centers of consumption is very important if the needs of the container industry are to be met.

Since approximately one-half of the volume of the highest quality aspen timber in the Lake States is located in Minnesota, production for shipment to plants remote from this region is not too favorable at the present time. For example, container manufacturers in Lower Michigan would have to pay substantial freight charges to have this lumber shipped to them. To secure markets in this area would mean putting good quality aspen lumber on the market at a price low enough to offset the transportation costs and meet competition of other woods now on the market. This is not the situation at present. Today, No. 2 and better southern yellow pine can be purchased at $60.00 per MBF f.o.b. mill, and ponderosa pine dressed, No. 3 and better is delivered into Grand Rapids, Michigan, at $80.00 per MBF. Rough, ungraded, log-run aspen is still quoted in some areas at $45 to $55 per

MBF f.o.b. mill, although reports are that some producers are offering their lumber for less. Freight rates from Minnesota to Grand Rapids, Michigan, are 37 cents per 100 pounds; from the southern states about 52 cents per 100 pounds, and from the west coast about 92 cents per 100 pounds. As compared to $15.81 per 1,000 board feet for green rough aspen, the freight rate into Grand Rapids on a car of dressed ponderosa pine will run about $18.50 per 1,000 board feet, and on southern pine $11.00 per 1,000 board feet, dressed, or $15.00 per 1,000 board feet, rough. The differential of $2.69 between freight rates on ponderosa pine and aspen will be easily offset by the generally higher quality of the pine lumber which will produce a maximum number of box shook cuttings with a minimum amount of labor. These are factors that must be considered by the aspen lumber producers in holding or gaining new markets for container lumber.

MEANS FOR INCREASING USE OF ASPEN FOR CONTAINERS

The use of aspen for containers can be increased if certain essential steps are taken.

Lower Costs of Production

Current prices of aspen lumber are based on present high operating costs. Many aspen operators priced themselves out of the market just after O.P.A. ceilings were lifted, when aspen went to $55 to $80 per MBF. To recapture the markets, lumber producers will have to overcome buyer resistance by putting out higher quality, seasoned, well-graded aspen lumber at prices comparable to those of competing species.

The following statement is quoted from a recent letter written by the Secretary-Manager of the Central Wooden Box Association, Chicago, Illinois: "While aspen is suitable for manufacture of a good many boxes and doubtless will be used by the box manufacturers located close to producing areas, there are many who would prefer ponderosa pine when it can be obtained at comparable prices. It is my impression from talking to some box manufacturers that aspen lumber has gotten too high in price by comparison with ponderosa pine."

To bring the selling price down to competitive levels operators will have to reduce logging and milling costs. Too many woods and mill operators still follow methods used 30 years ago. Modern methods of logging require mechanization to reduce labor costs and increase production. The center split-resaw mill has reduced milling costs and has improved volume production as full width boards are produced. This method of milling has one disadvantage, however, in that quality of lumber is reduced because rot, stain, and other disqualifying features are usually confined to the center of the logs. The portable circular mill still offers the most economical means of producing aspen lumber from small logs if the mill is efficiently operated.

The development of a small portable high-speed band mill as a substitute for the conventional circular mill would increase production of

quality lumber from small aspen timber. Felling with power saws, tree length logging with logging arches and bucking logs or bolts at the landing or sawmill site, use of high-speed loading equipment and hauling with heavy-duty, fast trucks are improvements that should reduce labor costs.

Segregate Logs and Bolts of Different Grades

The scattered nature of saw timber trees in an aspen stand and the corresponding small volume per acre of saw timber often make selective logging impossible, and consequently the smaller-diameter trees of pulpwood size are removed in the same cut. Products such as veneer, pulp, excelsior bolts, and railroad ties should be separated from the sawlogs to permit getting out logs which will yield the highest grade of lumber possible. An operation of this nature, to be successful, must have markets for all forest products harvested.

Sort Lumber for Highest Use - Revise Grading Rules

In the sawmill lumber should be sorted for its highest uses. The wider and longer boards could be segregated for better types of shipping containers, and the narrower, shorter material for cheaper containers and such items as core stock, where narrow widths are frequently desirable and shorter lengths usable. Lower grade lumber not meeting either of the above specifications could be sold as crating or dunnage lumber.

Aspen lumber is graded under both softwood and hardwood grading rules. Hardwood rules require that certain percentages of long boards and wide widths be included in the lumber pile regardless of grade. This frequently causes high-grade lumber to be down graded because the major portion is produced in 100-inch lengths from small diameter logs and bolts. For example, grade recovery figures of aspen lumber under basswood grading rules, with length and width waived, from a northern Minnesota sawmill gave:

30 to 35 percent 1C and better - box bolt grade - 6 inches and over
30 percent 2C
30 to 40 percent 3C

It is suggested that modified grading rules be adopted in the Lake States to recognize the above peculiarities of aspen lumber production and permit it to be sold on a special 8-foot box grade for container use. As the bulk of aspen lumber production now goes into container stock, the revised grading rules should be worked out in cooperation with representatives of the container industry and lumber associations.

Develop New Markets

Aspen lumber markets built up during wartime have fallen off, particularly in the wood-using industries outside the production area. Higher

prices, lack of grading, improper seasoning, buyer resistance, and availability of other kinds of lumber are factors in the market slump.

To capture and expand aspen lumber markets, operators should produce the kind of lumber required by the container industries on a volume basis. The sales appeal and value of aspen container lumber could also be increased by kiln drying and planing so that light-weight dressed lumber could be shipped instead of the customary rough green lumber.

The formation of some type of Aspen Producer Cooperative or Sales Agency operating on a cooperative basis would probably meet this need. Such an organization could carry on promotional and advertising activities and could concentrate and grade aspen lumber from small producers on a volume basis. The cooperative could acquaint the container industry with the merits of aspen lumber as container material. They could also promote aspen as a special use container wood in setting forth its advantages over softwoods for certain types of boxes. This group could also influence non-users of aspen to experiment with trial runs. It could market high-grade, uniform quality aspen lumber at a price comparable to or lower than competing woods and guarantee volume shipments to consumers.

One such cooperative is now being promoted in northern Minnesota. Several aspen producers with the help of the State of Minnesota are setting up a wood-processing cooperative designed to help solve the aspen-marketing problem. This cooperative will take in the output of small mills, dry the lumber, surface, grade, and market it.

Establish Container Plants Near Source of Supply

The best source of aspen timber supply is at present remote from the existing container manufacturing plants. Establishment of modern container and box shook plants at or near the source of wood supply would cut down transportation costs of raw wood materials by reducing length of haul of green material, a portion of which is unusable due to defects and small size. If container plants were nearer the source of supply, greater production of boxes and shooks at lowered costs would result and greater use of low-grade aspen stands would be possible.

Encourage Packaging of Farm Produce in Aspen Containers

Another possibility of increasing the use of aspen for containers is in the marketing of farm produce in packaged form either at the farm or from roadside stands. Tourists who are chief customers of roadside stands seldom carry containers in which to carry produce purchased. By having the produce packaged in a neat aspen container, the vendor would increase the attractiveness and sales value of his stock. This packaging idea could be fostered by county agents, farm marketing associations, and tourist bureaus.

Container plants could, if necessary, produce the box parts and sell them knocked down in bundles, to the farmer. The farmer could then assemble

and nail up the boxes in his spare time during the winter and spring months.

Produce More Box Shooks

The more extensive marketing of aspen container material in the form of shooks as well as lumber merits serious consideration. From the consumer's standpoint, this would eliminate the disadvantages inherent in short and narrow lumber so prevalent in aspen. Manufacture of shook on any large scale would require concentration plants equipped with box machinery. It should widen the shipping radius of aspen container material because the shook would be 100 percent usable. It should also make the waste more usable by concentrating it in fewer places.

Increase Research

More experiments should be carried on with aspen as container material by the Forest Products Laboratory and by industry along these lines: (1) Ways and means of better utilizing lower grades of aspen lumber for containers. (2) Production of aspen veneer for container stock. (The basket and panel industries offer a good outlet for aspen veneer and could absorb several million board feet of veneer or logs, if readily available. Aspen veneer should also be of considerable value in the wire-bound container industry.) (3) Development of more mechanized box factory equipment for using narrow and random widths of lumber.

Managing Aspen Stands for Steady Supply

Aspen saw timber stands have been those most heavily exploited, particularly by the pulpwood industry. In many cases smaller merchantable aspen timber has been by-passed. To insure a continuous supply of aspen timber for the future, more intensive management of the better-site aspen stands will be required. Sustained cutting units should be set up in order that lumber operations may be conducted at minimum costs. Managers of aspen stands should give consideration to the proximity of regular and potential markets for container material in relation to shipping and transportation costs. Also the possibilities of managing aspen for veneer stock should not be overlooked.

SUMMARY

Because of the abundance of aspen timber in the Lake States and the suitable properties of the wood, aspen lumber definitely has a place in the container industry of the future.

The use of aspen for containers will depend on producers' initiative in lowering costs of production, manufacturing better quality lumber, putting the lumber on the market at a price no higher than that of competing woods, and assuring container manufacturers of an adequate, continuous supply of lumber to meet their needs.

The use of aspen as a container material can be increased by (1) Mechanizing logging and milling operations to obtain lower costs; (2) segregating forest products in the woods to improve log quality, and sorting lumber at mill for highest use; (3) setting up cooperative concentration yards to provide local markets for the large volume of aspen lumber produced by small operators so that it can be dried, graded, and shipped out on a volume basis; (4) exploring container veneer possibilities; (5) developing mill and box machinery to cut up small timber and utilize narrow and short dimension lumber; (6) exploring possibilities of locating box and shook plants at or near aspen supply areas; (7) additional research in use of aspen as container material by federal and state agencies and industry.

Table 1.- Average mechanical and physical properties of clear wood of aspen compared with other species 1/

Species	Weight per cubic foot: Green (1)	Weight per cubic foot: At 12 percent moisture content (2)	Shrinkage (3)	Bending strength (4)	Compressive strength (endwise) (5)	Stiffness (6)	Hardness (7)	Shock resistance (8)	Nail-holding power (9)	Splitting resistance (10)
	Pounds	Pounds	Points	Points	Points	Points	Points	Points	Points	Points
Aspen	43	27	100	100	100	100	100	100	100	100
Bigtooth aspen 2/	43	27	105	105	119	121	123	94	105	131
Basswood	41	26	142	97	107	118	100	81	101	118
Eastern cottonwood 2/	49	28	124	98	110	115	116	109	99	169
Balsam poplar 2/	40	23	94	76	83	89	81	64	...	96
Yellow poplar	38	28	107	113	117	126	129	87	112	171
Northern white cedar	28	22	62	79	90	73	97	70	80	93
Balsam fir	45	26	93	94	116	110	100	75	...	76
Eastern hemlock	50	28	88	114	136	113	165	100	117	88
Jack pine	50	30	92	102	126	104	155	116	129	127
Eastern white pine	36	25	75	100	116	111	113	82	114	98
Eastern spruce (commercial) 3/	34	28	113	111	129	121	126	101	113	100

1/ This table is for use in comparing the clear wood of aspen with that of other species, or for comparing aspen lumber with lumber of other species containing like defects.
2/ Sometimes sold mixed with aspen under the commercial name of popple.
3/ Average red and white spruce.
(From: Johnson, R. P. A., Mechanical Properties of Aspen, Lake States Aspen Report No. 7, Forest Products Laboratory.)